WHAT IS CLAIMED IS:

1. A handheld ultrasound device weighing less than fifteen pounds, including a transducer, beamformer and image processor and a first digital signal processor capable of processing B mode and flow (2D Doppler) scans, having an second digital processor block comprising:

a digital Doppler QBP filter (FPGA) for filtering PW Doppler signals; and

a second digital signal processor core for PW Doppler signal processing.

2. The handheld ultrasound device of claim 1, more preferably weighing less than ten pounds.

3. The handheld ultrasound device of claim 1, even more preferably weighing less than seven pounds.

4. The handheld ultrasound instrument of claim 1, wherein the first digital signal processor, the second digital signal processor and the FPGA are unified onto a single application specific integrated circuit (ASIC) chip.

5. The handheld ultrasound device as described in claim 1, wherein the beamformer, image processor, first and second digital signal processors and FPGA are integrated into a single ASIC chip.

6. The handheld ultrasound device of claim 1, wherein the second digital signal processor for performing M mode interpolation, digital Doppler QBP filtering and PW Doppler signal processing are located on a digital signal processing application specific integrated circuit (ASIC) chip.

7. The handheld ultrasound device of claim 1, further comprising a time-motion display capability (M mode) wherein the M mode signal processing occurs on the first digital signal processor using a micro-code block, and interpolation of M-mode signal for video display is done on the second digital signal processor.

8. The handheld ultrasound device of claim 1, further comprising a means for performing tissue harmonic imaging.

9. The handheld ultrasound device of claim 1, further comprising a serial I/O port for sending and receiving data to peripheral devices.

10. The handheld ultrasound device of claim 1, further comprising a CW Doppler circuit having a CW beamformer ASIC and a supplemental circuit for A/D filtering and performing analog to digital conversion on I and Q signal pairs, wherein the FPGA of the second digital processor block processes complex data at a constant sample rate prior to processing through the second digital signal processor core.

11. The handheld ultrasound device of claim 10, having circuitry for performing transmit and receive signal control combined with a CW beamformer on a single ASIC chip, and having I/O ports for access to other process circuitry (2D, M mode, B mode).

12. An ultrasound diagnostic instrument comprising:.

a) a handheld module including a display, manual controls, and system circuitry for processing signals for display;

b) a transducer assembly coupled to the system circuitry for providing electrical signals from ultrasound waves for processing; and

c) an electrocardiograph (ECG) module coupled to the handheld module by a cable and including leads for receiving ECG signals from a patient and ECG signal processing circuitry for applying ECG signals to the handheld module through the cable.

13. The ultrasound diagnostic instrument as defined by claim 12, wherein the ECG module receives control and power signals from the handheld module.

14. The ultrasound diagnostic instrument as defined by claim 12, wherein the signal processing circuitry of the ECG module includes first amplification and filtering circuitry for signals from the leads and second amplification and filtering circuitry for processing signals from the first amplification and filtering circuitry for application to the handheld module, the first and second amplification and filtering circuity being electrically isolated whereby a patient is electrically isolated from the handheld unit.

15. The ultrasound diagnostic instrument as defined by claim 14, wherein the first amplification and filtering circuit receives electrical power from the handheld

module, the electrical power being capacitively coupled to the first amplification and filtering circuitry.

16. The ultrasound diagnostic instrument of claim 15, wherein the transducer assembly is coupled to the system circuitry through a cable.

17. The ultrasound diagnostic instrument as defined by claim 15, wherein the transducer assembly is integral with the handheld module.

18. The ultrasound diagnostic instrument as defined by claim 12, wherein the signal processing circuitry of the ECG module includes first amplification and filtering circuitry for signals from the leads and second amplification and filtering circuitry for processing signals from the first amplification and filtering circuitry for application to the handheld module, the first and second amplification and filtering circuitry being optically coupled.

19. The ultrasound instrument as defined by claim 18, wherein the first and second amplification and filtering circuitry are being magnetically coupled.

20. The ultrasound instrument as defined by claim 18, wherein the first and second amplification and filtering circuitry are being capacitively coupled.

21. The ultrasound diagnostic instrument as defined by claim 12, wherein the transducer assembly is coupled to the system circuitry through a cable.

22. The ultrasound diagnostic instrument as defined by claim 12, wherein the transducer assembly is integral with the handheld module.

23. The ultrasound diagnostic instrument as described in claim 12, wherein said hand held module further comprises circuitry for performing spectral Doppler analysis and allowing for simultaneous ECG readings to be overlaid on a spectral Doppler display.

24. For use with a handheld ultrasound diagnostic instrument, an electrocardiograph (ECG) module comprising:

leads for receiving ECG signals from a patient;

ECG signal processing circuitry; and

a cable for applying ECG signals from the ECG signal processing circuitry to the handheld module.

25. The ECG module as described in claim 24, wherein the ECG module receives control, clock and power signals from the handheld ultrasound diagnostic instrument.

26. The ECG module as defined by claim 25, wherein the signal processing circuitry of the ECG module includes first amplification and filtering circuitry for signals from the leads and second signal amplification and filtering circuitry for processing signals from the first amplification and filtering circuitry for application to the handheld ultrasound diagnostic instrument, the first and second amplification and filtering circuitry being optically coupled.

27. The ultrasound instrument as defined by claim 26, wherein the first and second amplification and filtering circuitry are being magnetically coupled.

28. The ultrasound instrument as defined by claim 26, wherein the first and second amplification and filtering circuitry are being capacitively coupled.

29. The ECG module as defined by claim 26, wherein the first amplification and filtering circuitry receives electrical power from the handheld module, the electrical power being capacitively coupled to the first amplification and filtering circuitry.

30. The ECG module as defined by claim 24, wherein the signal processing circuitry of the ECG module includes first amplification and filtering circuitry for signals from leads and second amplification and filtering circuitry for processing signals form the first amplification and filtering circuitry for application to the handheld ultrasound diagnostic instrument, the first and second amplification and filtering circuitry being optically coupled.

31. Te ultrasound instrument as defined by claim 30, wherein the first and second amplification and filtering circuitry are being magnetically coupled.

32. The ultrasound instrument as defined by claim 30, wherein the first and second amplification and filtering circuitry are being capacitively coupled.

33. In an electrocardiograph (ECG) module having first signal processing circuitry for processing ECG signals from a patient and second signal processing circuitry for further processing of the ECG signals for diagnostic use, a power supply circuit for providing electrical power from the system to the first signal processing circuitry comprising:

a) a serial inductive path for receiving a DC voltage and a shunt capacitive path and a shunt switch connecting the serial inductive path to a power ground;

b) a first coupling capacitor for coupling the serial inductive path to the first signal processing circuitry and a second coupling capacitor for coupling the power ground to the first signal processing circuitry; and

c) a rectifying circuit in the first signal processing circuitry including a forward polarity diode connecting the first coupling capacitor to a first terminal of a positive charge capacitor and a reverse polarity diode coupling the first coupling capacitor to a first terminal of a negative charge capacitor, and an isolated reference terminal connected to the second coupling capacitor and to a second terminal of the positive charge capacitor and to a second terminal of the negative charge capacitor whereby electrical power is coupled through the coupling capacitors to the charge capacitors at the frequency of the shunt switch.

34. The power supply circuit as defined by claim 33, wherein the electrocardiograph module is used with a handheld ultrasound diagnostic instrument and includes patient isolation from the system power supply which meets the requirements of ANSI/AAMI EC13 specification.

35. A power interface for coupling DC power from a non-isolated system to signal processing circuitry isolated from the system power supply comprising:

chopping circuitry for chopping DC power supply voltage of the system;

coupling capacitors for coupling power supply voltage to isolation circuitry; and

rectifying circuitry in the signal processing circuitry for receiving and rectifying the capacitively coupled chopped DC voltage.

36. The power interface as defined by claim 35, wherein the chopping circuitry comprises serially connected inductors connected to one coupling capacitor and a shunt capacitor and a shunt switch connecting a common terminal of the serially connected inductors to the power supply system ground and the second coupling capacitor.

37. A lightweight, handheld system for performing electrocardiography comprising:

a handheld ultrasound device weighing less than seven pounds having a transducer, a beamformer, an image processor and one or more digital signal processors for signal filtering, detection and mapping; and

a portable electrocardiogram monitor weighing less than three pounds and having at least three electrical leads for measuring electrical potential across a person's chest, a differential amplifier for amplifying the measured electrical potential, a plurality of signal filters and gain amplifiers, and a means for electronically isolating the measured signal from other electrical inputs and interferences.

38. The system of claim 37, wherein the plurality of signal amplifiers further comprise a bandpass filter, a highpass filter, and a lowpass notch filter.

39. A method of performing spectral Doppler analysis in a hand held ultrasound system comprising the steps of:

(a) analyzing the display data to restructure the original power frequency spectrum;

(b) performing a temporal smoothing on the frequency spectrum;

(c) determining the absolute value deviation for each frequency spectrum;

(d) determining the mean power per frequency spectrum;

(e) applying one of several fixed smoothing filters to each frequency column;

(f) finding the maximum value before the mean of each frequency spectrum;

(g) establishing a frequency spectrum threshold;

(h) employing a peak finding algorithm;

(i) applying a fixed width filter for temporal smoothing; and

(j) reversing the process of (a) to return the image data to the size appropriate for the system display.

40. The method of claim 39, wherein step (b) is omitted.

41. In a programmable diagnostic ultrasound instrument having stored software and data for operation control, a software security mechanism which restricts

modification of software or data including an algorithm which generates a keycode based on a unique system identifier which allows a person or agency to perform a system or data update.

42. The programmable diagnostic ultrasound instrument of claim 41, wherein the system or data update is performed through a detachable scanhead.

43. The programmable diagnostic ultrasound instrument of claim 41, wherein the software security mechanism is a signature generator.

44. The ultrasound instrument of claim 41, being a portable ultrasound instrument.

45. The ultrasound instrument of claim 41, being a hand held ultrasound instrument.

46. The ultrasound instrument of claim 41, weighing less than ten pounds (4.5 kg).

47. An ultrasound instrument having a software library and data for operational control stored on a persistent memory device, and having a means for securely enabling and disabling applications within the software library.

48. A programmable diagnostic ultrasound instrument having a plurality of diagnostic modes, wherein access to the diagnostic modes is controlled through a gate flag registry, the gate flag registry capable of modification through a verification procedure utilizing a secure means for extracting hidden bits from a keycode based on one or more unique system identifiers.

49. The programmable diagnostic ultrasound instrument of claim 48, wherein the verification procedure for extracting hidden bits from a keycode further comprises a compound algorithm including a signature generator, an encryption algorithm and a reversible logic operation, the compound algorithm being capable of verifying a keycode when operated in a decryption mode, and able to produce a verification data string having error detection bits, signature bits, and option bits.

50. The compound algorithm of claim 49, wherein more than one signature generator is used.

51. The compound algorithm of claim 49, wherein more than one encryption algorithm is used.

52. The programmable diagnostic ultrasound instrument of claim 49, wherein the compound algorithm further comprises a plurality of algorithms dependent upon each other for input values of various stages of their logic, a first algorithm producing a first bit string used by the second algorithm to produce a second bit string, the second bit string being required by the first algorithm to produce a new bit string n_{x+1} needed by said second algorithm to produce a new bit string n_{x+2}, wherein the logic strings (n_{x+y}) are used by said first algorithm and said second algorithm until the plurality of algorithms complete all logic operations and produce a final bit string n_{xf}.

53. The programmable diagnostic ultrasound instrument of claim 52, wherein the logic of the dependent algorithms may be executed in reverse to produce any one of the input values produced by the other algorithm, or any one of the starting input values.

54. The programmable diagnostic ultrasound instrument of claim 52, wherein at least one of the algorithms is a data encryption algorithm.

55. The compound algorithm of claim 49, wherein the reversible logic operation is any logic operation capable of combining the bit strings of the signature generator and the encryption algorithm to produce a keycode when run in encryption mode, and produce the necessary verification data string when run in decryption mode.

56. The programmable diagnostic ultrasound instrument of claim 48, wherein the verification procedure is executed through an application specific integrated circuit (ASIC) that draws instrument specific information from either a software data structure, or a hardware data registry.

57. The ultrasound instrument of claim 48, being a portable ultrasound instrument.

58. The ultrasound instrument of claim 48, being a hand held ultrasound instrument.

59. The ultrasound instrument of claim 48, weighing less than ten pounds (4.5 kg).

60. In a programmable diagnostic ultrasound instrument having stored software and data for operation control, a software security mechanism which restricts modification of software or data utilizing a 64-bit mixing algorithm and a bit-wise signature generator within an architecture using a X-OR logic to perform reversible encryption and decryption operations, thereby allowing a user to change software or data using a short sequence of numbers while providing the security of a large bit string verification scheme enabling signature verification, error correction and licensing verification.

61. The programmable diagnostic ultrasound instrument of claim 60, wherein said instrument is a hand held device.

62. The programmable diagnostic ultrasound instrument of claim 60, weighing less than ten pounds (4.5 kg).

63. A system for the tracking diagnostic modes in one or more programmable diagnostic ultrasound instrument(s) comprising:

a) a general purpose computer having a means for generating a unique keycode for each programmable diagnostic ultrasound instrument, the keycode having encrypted error detection bits, signature bits and options bits for enabling diagnostic modes in a particular instrument;

b) at least one programmable diagnostic ultrasound instrument having a plurality of diagnostic modes that can be enabled or disabled upon successful verification of the keycode, the verification procedure utilizing a secure means for extracting hidden bits used to modify a gate flag registry from the keycode; and

c) a data structure for centrally recording and tracking diagnostic modes of each diagnostic ultrasound instrument.

64. A system as described in claim 63, wherein each programmable diagnostic ultrasound instrument links into a central database and receives a verification code

from the central database before any changes in the software libraries of the diagnostic ultrasound devices may be implemented.

65. The system as described in claim 64, wherein a person links into the central database by calling a database controller to receive a verification code via a telephone or fax machine.

66. The system of claim 64, wherein the verification code is a keycode which must be verified by the diagnostic ultrasound device through a logic process utilizing unique system identifiers, said unique system identifiers being unique for each said diagnostic ultrasound device.

67. A method of upgrading the functional software of a programmable diagnostic ultrasound instrument comprising the steps of:

(a) generating a keycode generation algorithm comprising at least one encryption algorithm, at least one signature generator, and a reversible logic operation for mixing a bit string produced by said encryption algorithm and a bit string produce by said signature generator;

(b) generating a keycode using the keycode generation algorithm, said keycode utilizing data specific to a programmable diagnostic ultrasound instrument and data relating to a desired software upgrade;

(c) inputting the keycode obtained from the step (b) into the programmable diagnostic ultrasound instrument; and

(d) verifying the keycode generated by step (b) in the programmable diagnostic ultrasound instrument, using a reversing algorithm of step (a) to compare and verify the signature bits, error detection bits and option bits.

68. The method of claim 67, wherein step (b) further comprises the steps of:

(b1) inputting instrument specific information into a keycode encryption algorithm;

(b2) poviding one or more secret constants to the keycode encryption algorithm;

(b3) executing the operation of the encryption algorithm;

(b4) choosing a series of options to enable, each option coding for a desired software upgrade, in the programmable diagnostic ultrasound instrument and entering the series of options into a signature generator algorithm;

(b5) generating a first bit string in the signature generator having an equal length to a second bit string produced by the encryption algorithm;

(b6) executing a X-OR function on the first and second bit strings to produce a third bit string;

(b7) converting the third bit string to a decimal string; and

(b8) producing a keycode.

69. The method of claim 67, wherein step (c) further comprises the step of:

(c1) loading a new software application into the programmable diagnostic ultrasound instrument; and

(c2) enabling the new software application by inputting the keycode obtained from the vendor, into the programmable diagnostic ultrasound instrument.

70. The method of claim 67, wherein step (d) further comprises the steps of;

(d1) converting the license string into the X-or bit string;

(d2) generating a second bit string by running the encryption algorithm internally within the programmable diagnostic ultrasound instrument;

(d3) reversing the X-or logic on the X-or bit string and the second bit string to produce a first bit string;

(d4) isolating the signature bits, option bits and error detection bits of the first bit string;

(d5) comparing the signature bits, the option bits and the error detection bits generated by the reverse X-or first bit string to the internally generated first bit string; and

(d6) enabling the necessary options programmed through the option bits.

71. The method of claim 67, further comprising the step of recording in a database the particular options that are enabled on a particular programmable diagnostic ultrasound instrument.

72. The method of claim 67, wherein the programmable diagnostic ultrasound device is portable.

73. The method of claim 67, wherein the programmable diagnostic ultrasound device is hand held.

74. The method of claim 67, wherein the programmable diagnostic ultrasound device is less than ten pounds (4.5 kg).

75. The method of claim 67, wherein the logic is executed within an application specific integrated circuit (ASIC) using one or more fixed registries for input values.